



2001 Avian Inventory Annual Report for Southern Colorado Plateau National Parks:

Aztec Ruins National Monument

El Morro National Monument

Petroglyph National Monument

Salinas Pueblo Missions National Monument

Yucca House National Monument

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ABSTRACT

Five National Parks and Monuments in the Southern Colorado Plateau Network were surveyed for the presence of birds from mid May to mid July 2001. The Parks surveyed were: Aztec Ruins NM (AZRU), El Morro NM (ELMO), Petroglyph NM (PETR), Salinas Pueblo Missions NM (SAPU) and Yucca House NM (YUHO). The primary objective of the study is to provide a baseline inventory of avifauna in each park with the goal of documenting 90% of species present. A secondary objective is to determine general abundance and distribution of species present, identifying park-specific species of special concern. A second season of field inventories will be completed in these same parks during 2002.

INTRODUCTION

This avian inventory project is one component of a suite of biological inventories being conducted within the Southern Colorado Plateau Network as part of a new national emphasis of inventory and monitoring within the National Park Service. During 2001, breeding avian inventories were completed in the following parks: Aztec Ruins NM, El Morro NM, Petroglyph NM, Salinas Pueblo Missions NM and Yucca House NM. The level of existing information on avifauna for these parks varied from little to no information. Species presence/absence had not been adequately determined for most of these parks, and information on the occurrence of species of special concern was limited. With such a lack of baseline information, these five parks have limited ability to develop management guidelines for avifauna.

Information gained from this work can be used to identify an optimal design for an efficient and effective long-term monitoring program for each park throughout the Colorado Plateau. It will also directly contribute to the development of monitoring and research programs that provide information on what is there, how things are changing, and what can be managed.

A well-designed monitoring program must be built upon a comprehensive understanding of the work that has already been done (Noon 2001). Monitoring data should enable detection of environmental change, provide insights to the ecological consequences of these changes, and help decision-makers determine if the observed changes mandate changes in management practices (Noon et al. 1999).

Bird communities and species are often studied and monitored in hopes of gaining insight into physical and biological phenomena, such as changes in climate, habitat, human disturbance, or environmental contaminants. When justifying the use of birds as models for such monitoring, researchers typically argue that birds are good indicators of change because they respond quickly to habitat changes, are influenced by a suite of often subtle factors, and exhibit strong habitat selection (Cody 1985). In general, birds are considered a valuable monitoring tool because they tend to have dynamics that parallel those of the ecosystem or component of interest, provide continuous assessment over a wide range of stress, have dynamics that can be attributed to either natural cycles or anthropogenic

stressors, are distributed over wide geographical area/or are very numerous, can be accurately estimated, have costs of measurement that are not cost prohibitive, are low impact to measure, and can have measurable results that are repeatable with different personnel.

Also, many of the endangered, threatened or sensitive species that we are mandated by federal and/or state regulations to manage and conserve are birds. Significant changes in bird species or populations may alert us to look more closely for changes in the quality or quantity of habitats. It is only through adequate, well-designed and executed monitoring programs that we can track species or population changes, begin the search for causative factors, and/or initiate conservation and management actions.

Southern Colorado Plateau Parks: Background Information

Each of the parks has some documented bird species presence/absence, but little information on abundance or distribution. They may not have sampled or have undersampled birds in some habitats. General information on bird distribution, nativity, and habitat in New Mexico and Colorado is compiled herein, but this information is too general to interrelate to individual parks. These parks needed a baseline inventory of breeding birds in major habitats within the park with the goal of documenting 90% of the species present.

Aztec Ruins National Monument (AZRU)

AZRU is located in the Animas River valley in northwestern New Mexico. The site includes riparian, lowland, and upland areas. The natural resources of this site, including water, croplands, and riparian vegetation, were important to the prehistoric inhabitants. Today, these same resources are an important aspect of the monument, and provide a context for understanding the development of the Chacoan culture. Inventory of plant and animal species is necessary to establish a baseline of abundance and distribution in order to detect future changes due to development within the park. The presence of threatened, endangered, and other sensitive plant and animal species should be documented so that protection can be assured during development (e.g., new buildings, trail work, fences, oil and gas leases). There is also a need to identify, map, and eradicate noxious weeds to prevent further encroachment and to meet federal mandates. Baseline data are also needed in order to plan the revegetation of areas disturbed by roads, grazing, and agricultural use.

Very little systematic natural resource inventory work has been conducted at Aztec Ruins National Monument. A survey for sensitive, threatened, and endangered species of the Aztec Ruins National Monument area was conducted under contract by Ecosphere Environmental Services, Inc. (1996). Fieldwork for this survey of a 4-acre tract adjacent to the Monument recorded 35 species of grasses, forbs, trees, and shrubs. Clark (1950) recorded plants of the Sonoran zone in the AZRU region, but this is not a complete listing of the flora of the area. In all, 11 vegetation types have been reported, ranging from pinyon/juniper woodland, grasslands, to riparian vegetation types.

Wildlife species were not recorded for this survey, but the project report includes a hypothetical species list of plants and vertebrate animals for the AZRU area. This list includes 18 bird species.

El Morro National Monument

El Morro, located in western New Mexico, features a sandstone monolith rising 200 ft above the valley floor. Proclaimed on December 8, 1906 and including boundary changes on June 18, 1917 and June 14, 1950, the monument now consists of 1,040 acres federal and 240 acres of nonfederal lands. Inventory of plant and animal species of the monument would provide information for management decisions on resource issues, including the occurrence of rare and endemic species associated with the historic pool and box canyon.

An electronic list provided by ELMO staff includes plant species; McCallum (1981) and Stolz (1986) are the primary references for this list. A few references are "FWS, 1995" and several, "Schackel, 1984." An historical look at the vegetation is provided in Schackel (1984) through the use of comparison photography; the photographs show 100 years of effects from human activity at the Monument. Areas of concern include overgrazing, fire suppression, plant growth, and the incursion of pinyon/juniper woodland into the grassland community. The Monument does have an herbarium collection, but the number of specimens included is not available.

An electronic list provided by ELMO staff includes bird species, with most of the references being "Cibola, 1997." A few references are "FWS," and several, "DGF, 1996." Prior checklists include an annotated list by McCallum (1979) and a list by Stolz (1986). An Investigator's Annual Report (IAR) describes a one-day survey for the Mexican Spotted Owl (*Strix occidentalis lucida*) which found no evidence of nesting and no vocal response to calls. The report notes that habitat may be marginal.

Petroglyph National Monument (PETR)

Petroglyph National Monument is located in central New Mexico within the city of Albuquerque. Changes in the surrounding lands are likely to affect natural resources within the monument boundaries; these changes include increasing development and the increase in the number of exotic species. Inventory (and subsequent monitoring) will allow managers to determine changes in ecological communities resulting from natural cycles as well as anthropogenic pressures. Other factors that will be addressed using data from inventory and subsequent monitoring include the role of fire on the grasslands within Petroglyph National Monument, and the effects of pollutants on species and ecological communities.

A survey of the biological resources of Petroglyph National Monument listed 192 plant species found during an August 1994 survey. Specimens from the survey are housed at the Museum of Southwestern Biology at the University of New Mexico and at the Monument. However, this survey was not complete for inventory purposes. Information is particularly lacking on the annual flora. An unpublished report (Barlow-Irick 1993)

documents threatened and endangered species. A vegetation map is available, and nine vegetation types have been documented.

A comprehensive survey was conducted in the mid-1990's to provide baseline biological information on the relatively new Petroglyph National Monument (Bleakly et al. 1996). The report contains sections written individually by specialists from the University of New Mexico describing the inventory processes and listing species recorded. This report includes a bird checklist.

Salinas Pueblo Missions National Monument (SAPU)

Salinas Pueblo Missions is located near the Cibola National Forest in central New Mexico. Established in 1980 through the combination of two New Mexico State Monuments and the former Gran Quivira National Monument, the present Monument comprises a total of 1,1071 acres. Natural resource needs are for aquatic biology studies and the identification of rare or unusual species associated with streams and wetlands.

Floristic and vegetation work has been largely completed at SAPU (NPS unpublished data, Floyd-Hanna et al. 1994). Vegetation surveys, including plant specimen collections, were conducted in 1992-93 at the Abo and Quarai Units of Salinas Pueblo Missions NM. Initial assessment shows 12 plant communities within the Abo Unit and the Quarai Units. Some of the vegetation types for the Abo Unit consist of pinyon/juniper woodlands, salix-cottonwood riparian, oak brush, and tamarisk stands. Efforts to control tamarisk found both inside and outside the Abo Unit have been made. The Quarai Unit has a perennial water source that supports a more diverse community than the Abo Unit. Four possible riparian communities are cottonwood-willow, typha wetland, rose-horsetails, and pseudoriparian meadows. The Quarai uplands consist of pinyon/juniper-berberis woodlands, oak pinyon woodlands, open, early successional pinyon woodland, ponderosa pine stand, sagebrush-horsebrush stands, and various disturbed meadows and apple orchards remnant of historic occupation. Color infrared aerial and black-and-white photographs have been transferred into a geographic information system and some plant specimens are located at San Juan College. Currently, there are no known special status or listed plant species. A vegetation map also has been completed (Floyd-Hanna et al. 1994).

Little information has been reported on the birds of Salinas Pueblo Missions National Monument. A study by Scott (1979) included a bird list, but a letter from the New Mexico Department of Game and Fish (Hubbard, pers. comm.) criticizes the bird portion of this report. Besides some observations, a 1956 checklist (author unknown) seems to be the only other historical source.

Yucca House National Monument (YUHO)

Yucca House, in southwestern Colorado, was established by Presidential Proclamation of December 19, 1919, to protect "...an imposing pile of masonry of great archeological value...." Due to this primary charge of protection and research of cultural resources, data on plant and animal species are lacking at Yucca House.

A flora survey of the original Monument, compiled by Mesa Verde NP staff, shows the dominant shrub is greasewood (*Sarcobatus vermiculatus*), and 85% of the dominant understory is nonnative cheatgrass. A plant list for the Monument, which is surrounded by agriculture lands, lists 67 plant species. This list was updated in February 2000, based on surveys and field notes from Mesa Verde park staff and outside specialists and other agencies including the Colorado Division of Wildlife (George San Miguel, MEVE Resources Management Division, pers. comm.). A vegetation map has been completed and includes 11 habitat types (Colyer 1989).

Richert and Brandegee (1941) provide an early bird list for YUHO, with common and scientific names, and relative frequency. An up-to-date list has been compiled by Colyer (MEVE staff) from in-house records and observations. This list includes indications of habitat, relative abundance, residency and nativity status. Other available recent information consists only of informal lists, including a narrative list by Versaw (1990).

Recently, four hundred and sixty-nine ha (1200 acres) of surrounding agricultural and range land have been donated to the Monument, which was originally only 14 ha. The newly-acquired lands have not been surveyed for plants or vertebrates. Moreover, the lands have been heavily grazed, thus introducing concerns about grazing impacts and non-native weed infestations. Inventory and monitoring will be essential for determining presence and abundance of plant and animal species, and providing baseline information for monitoring effects of potential spring depletions, invasion by exotic species, and restoration of newly-acquired lands.

OBJECTIVES

The overall goals of these inventories for each park are to:

- 1) Document through existing, verifiable data and field investigations the occurrence of at least 90 percent of the bird species currently estimated to occur in the parks;
- 2) Using systematic surveys, document presence/absence of bird species, and their distribution and abundance in habitats that were historically under-sampled or not sampled;
- 3) Identify critical habitats – document locations of key breeding and non-breeding habitats where current records are lacking.
- 4) Species of Concern – document presence/absence of birds of special management concern that are known or expected to occur in the park units based on habitat or historic records. Identify park-specific species of special concern (which could become part of future “vital signs” monitoring).
- 5) Based on the inventory recommend an effective monitoring program so that Resource Management staff at each park can assess the condition of bird populations over time, and detect significant changes in those populations.
- 6) Summarize bird information in appropriate formats to contribute to the population of National Park Service, service-wide databases including NPSpecies, Dataset Catalog, NRBib, and ANCS+.

METHODS

Variable circular plot (VCP) surveys, area search surveys and tape playback recordings for nocturnal species were conducted. We conducted at least three surveys per habitat. Field methods were designed to provide the necessary data to estimate species richness, relative abundance and density of breeding birds.

Estimating Richness, Relative Abundance and Density of Breeding Birds

Species richness (number of species detected) and relative abundance (calculated as the percent of all detections; Sogge and Johnson in press) were summarized for the entire park and each major habitat type; these data are included in this report. Estimates of population density (number per unit area) will be determined for those species most commonly detected (>40 detections) after the second breeding season in 2002; these data will be included in the final report.

It is rarely possible to count all birds actually present in an area. Therefore, distance sampling methods were to estimate abundance or density. Distance sampling has been used for more than 30 years and has been found to be a reliable method for estimating relative abundance and population trends for many bird species (Fancy 1997, Nelson and Fancy 1999).

Distance sampling is based on the assumption that the distance between an observer and an object will affect the probability of detection; the further away an object, the less likely it is to be detected. In our surveys, we estimated the horizontal distance from an observer to a bird. Using these distances, we calculated a detection function, which is the probability of detecting an object given its distance from the observer. This detection function was used to estimate bird density, allowing for undetected birds (Buckland et al. 1993).

Distance sampling includes two approaches to estimate density: line transects and variable circular plots. For all five parks surveyed in 2001, variable circular point counts were used.

Variable Circular Plot Sampling

With variable circular plot sampling, the observer stands at a sampling station and records the horizontal distance between the observer and the bird. For many surveys, the majority of birds are heard but not seen, so observer estimates the distance to a tree, bush or other object where they think the bird is located. Variable Circular Plot (VCP) counts are the preferred approach in patchy habitats, where the objective is to correlate bird data to vegetation or other habitat information, and in dense, rugged or hazardous terrain, where you need to watch your footing as you walk.

Data Collection Methodology

We established point count stations to sample each habitat at all five park units. Depending on stand size and shape, point count stations were located 250 meters apart in each habitat type. Between each habitat type, a 200-meter buffer was implemented. At each point count station, habitat and vegetation data were collected on a standardized form, and GPS coordinates were recorded.

At El Morro and Petroglyph, sampling sites were stratified according to habitat; random points were generated by GIS within each habitat type, and points were selected by surveyors for accessibility. Those points which fell on steep, inaccessible slopes were moved whenever possible to nearby, contiguous terrain.

Three to four visits were conducted to cover the period in which the greatest number of passerine bird species would be exhibiting breeding behavior, such as territorial calling and singing. Surveys started at one-half hour after sunrise and were completed by 1000. At each point count station, one observer recorded all individual birds seen or heard for 7 minutes; counting was subdivided into 3 periods: 0-3 minutes, 3-5 minutes and 5-7 minutes. Counting began 1 minute after arriving at a station. Bird detections were recorded to the nearest meter using laser rangefinders; The rangefinders that we used are accurate to within 1%.

Flyover species were also recorded, but with no estimates of distance. Additional notes were taken including: (1) whether the detection is aural, visual or both; (2) whether detections were songs, calls, or other (i.e., drumming wings), and (3) whether the bird was detected at a previous point count station (to avoid double-counting individuals). Birds flushed while walking between point count stations were counted and noted on our general bird observations form. Forms for point counts and general bird observations were modeled after those recommended by Ralph et al. (1995).

Additional Breeding and Non-breeding Surveys

Most bird survey methods provide good information for common species, but relatively sparse information for rare or secretive species. This does not mean the survey method is invalid; rather, it is a reflection of the difficulty of sampling rare and secretive species using general methods. Therefore, in addition to the point counts, an area search of all habitats during breeding and non-breeding periods was completed to increase the chance of detecting rare and secretive species that occur in the park. Personnel went to the different habitats (i.e., where point counts have been established) in the park and recorded all species they saw and/or heard. These surveys were conducted in conjunction with the standard survey protocol (i.e., point counts) during the breeding season.

During the non-breeding season (December – January) we will conduct two additional visits. These surveys will be conducted between 0900 and 1200, with an extra visit made in the late afternoon that may reveal presence of vultures, buteos, or any other birds not found in early morning (Robbins 1981). Survey data collected will include species encountered, habitat, location, dates, and general behavior.

Nocturnal Species

Nocturnal birds (specifically owls) were surveyed using taped broadcasts. Caprimulgids (i.e., Common Poor-wills, *Phalaenoptilus nuttallii*, and Lesser Nighthawks, *Chordeiles minor*) are vocal enough that playback recordings are rarely needed during these surveys. Owls, however, have been effectively surveyed using tape broadcasts and human vocalizations of the owl species songs and calls (Springer 1978, Forsman 1983). These surveys were conducted in all possible suitable habitats, or where historical sightings had been noted. Tape broadcasts or vocalizations were played for 15 minutes at each designated point. Surveys times occurred between 1 hour after sunset and 1 hour before sunrise. We conducted two surveys during the breeding season and will conduct two surveys during the non-breeding season. Survey data included species encountered, habitat, location, dates, and evidence of breeding status (i.e. courtship behavior, nests). All other nocturnal and crepuscular species were also noted.

Timing of Surveys

Three or four visits per park were scheduled so that surveys coincided with seasonal shifts in activity patterns of avifauna and to accommodate differences in overall active periods of different species. Both daytime and nocturnal surveys were conducted on each visit to each park. Surveys conducted during each visit are summarized below:

- Mid May to late May: First trip, 1 VCP and area search survey per habitat per day plus 1 nocturnal survey.
- Early June to mid June: Second trip, 1 VCP and area search survey per habitat per day plus 1 nocturnal survey.
- Mid June to early July: Third trip, 1 VCP and area search survey per habitat per day plus 1 nocturnal survey.
- Mid July: Forth trip, Sampling locale description and location documentation.

Sampling Locale Description and Location Documentation

Field crews recorded descriptive site information following a standardized format developed for use by all taxonomic groups in the Northern Colorado Plateau Network.

Global Positioning System (GPS) navigation units were utilized to record UTM coordinates for all inventory sampling points, transects, and other relevant locations. In some situations both UTM and latitude/longitude coordinate systems were recorded. All GPS coordinates used NAD27 as the datum reference. UTM coordinates, error values, datum reference and zone were recorded.

Data managers from the Southern Colorado Plateau Networks worked together with GIS staff at the Colorado Plateau Field Station on defining and describing the GPS protocol for use by field crews. The protocol included the use of GPS units with data dictionary capabilities for recording sampling site descriptive attributes.

Data Mining

As opportunities arose, the field crew assisted with acquisition of existing information for each park, including bibliographic citations of pertinent material for inclusion in the NPBib Database. In addition, existing bird datasets in the park could be abstracted for entry into the Dataset Catalog Database. The Northern Colorado Plateau Network (NCPN) provided the principal investigator with a summary of existing avian information for each park. Field crews helped add knowledge to the existing set of information through visits with park personnel and by examining park files.

Voucher Specimens

In general, bird specimens for NCPN parks are poorly represented within internal (NPS) and external museum collections. Bird voucher specimens were not collected as part of this inventory effort, except in cases where animals were found dead and in identifiable condition. All road-kills and other specimens found dead were collected and frozen. Individual voucher specimens have been delivered to Northern Arizona University for processing.

Photographing birds is often not feasible; however, where photographs were obtainable, all photographic vouchers were accompanied by a photo log (MS Excel) with species name, location, date and park name. Photographic vouchers consisted of 35mm-kodachrome slides or digital printout, and each were clearly labeled and archived at Northern Arizona University.

Data Analysis

The primary objective of this study was to provide a baseline inventory of avifauna in each park, with the goal of documenting 90% of species present. Species richness for each habitat type within the parks was calculated as the number of species detected during field surveys. To evaluate progress toward this objective we generated species-effort curves and jackknife estimates using the program PC-ORD 3.0 (McCune and Mefford 1995). In each habitat type, the average number of individuals of each species per point was used to examine species-effort relationships (number of species by number of survey points). The species-effort simulation uses jackknife estimates which subsamples the data set 500 times to determine the average number of species as a function of the size of the sub-sample. In addition to the classical “species-area curve”, the simulation also calculates mean dissimilarity between sub-samples and the overall species composition, as a function of sub-sample size, which uses the Sorenson index: $Is = 2w/a = b$; where w is the sum of the smaller of the two quantitative estimates of species abundance for each shared species and a and b are the sums of the quantitative values for all species in the first, second and third surveys respectively. 90% of the species have been detected when mean dissimilarity in bird assemblages is below 10%.

Jackknife estimators are non-parametric resampling procedures. The first-order jackknife estimator (Palmer 1990) is: $Jack1 = S + rl(n-l)/n$, where S = the observed number of species, rl = the number of species occurring in on sample unit and n = the number of sample units (survey points of a habitat type). The number of observed species in a

subsample will typically be smaller than the true number of species. The distribution of species among samples is sampled repeatedly to generate a frequency distribution used to estimate the true number of species in the area represented by the samples.

Density of each species with >40 detections will be estimated after we complete the second and final year of this project. When we analyze this data we will be using the computer program DISTANCE (Thomas et al. 1999). The distance data will be used to model detection functions, from which we can obtain unbiased abundance estimates for each species (Buckland et al. 1993). The advantages in using distance sampling data include: 1) multiple surveys can be combined to increase sample sizes. By combining surveys, it is possible to estimate densities of rare species, even in situations where only 1 or 2 birds are detected at some stations; 2) the method allows for adjustment of different covariates such as observer effect, effects of dense vegetation and detection distances; and 3) it will be possible to analyze historical count data if the park collected bird data using unadjusted point counts and the park then switches to VCP counts.

Coordination with the Northern Colorado Plateau Network

The Northern and Southern Colorado Plateau Networks agreed to utilize comparable field methods and data management for biological inventories. To this end we will utilize standardized field forms and data entry protocols across the two networks. The Northern Colorado Plateau Network Data Manager worked with us in designing standardized field forms and data entry screens. In cooperation with the Utah Division of Wildlife Resources field crews for both networks received joint training prior to the field season.

STUDY AREAS

Five national park units in the Southern Colorado Plateau Network were surveyed for presence of breeding birds from mid May to mid July. These parks include Aztec Ruins NM, El Morro NM, Petroglyph NM, Salinas Pueblo Missions NM and Yucca House NM (Figure 1). This region of the Colorado Plateau is typically dominated by desert scrub, grassland and pinyon/juniper habitats; spring and rivers provide isolated riparian zones. Park-specific habitat descriptions are provided below.

Aztec Ruins National Monument

The two main habitat types at AZRU are riparian and upland; grassy fields, desert scrub, and orchards occur in small patches within the monument. Due to its small size, no random points were generated. Instead, point count stations were established to survey the dominant habitat types. Two transects were set up, one in a riparian zone along the Animas River (four point count stations) and the other in upland habitat (seven point count stations). Five stations in the latter transect followed an irrigation ditch which provided a narrow riparian strip on either side. All point count stations were located 250 meters apart with a 200 meter buffer between habitat types.

Area searches were conducted to survey other habitats that were too small for transects. We conducted area search surveys in the orchard and upland habitat near the ruins and visitor center.

Figure 1. Map showing location of park units surveyed in the Northern and Southern Colorado Plateau Networks. Park units in Colorado and New Mexico are part of the Southern Colorado Plateau Network described in this report.



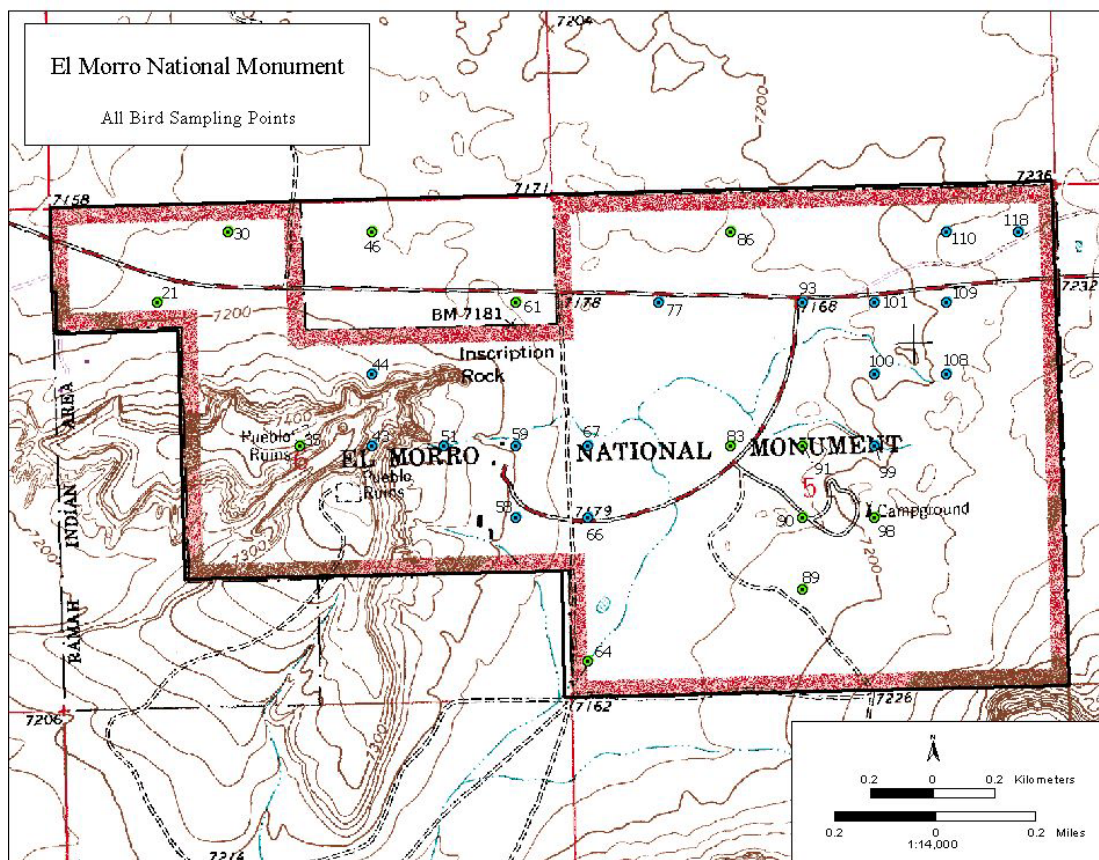
El Morro National Monument

At El Morro, 100 random points were generated and stratified according to habitat, slope, elevation and aspect (Figure 2). Those points which fell on a steep inaccessible slope were moved whenever possible to nearby, contiguous terrain. Two main habitat types were identified: grassland and pinyon/juniper. Transects were established in both of habitat types, each with seven sample points. A third transect, with eight points, was established in a narrow strip of deciduous pinyon/juniper habitat along the base of the cliffs.

Random points were selected for accessibility and survey-ability; non-random points were established in habitats not represented by the random points, or to fill in “gaps” between random points (i.e., random points were >500 m apart). All point count stations were located 250 meters apart with a 200 meter buffer between habitat types.

Area searches were conducted in and around the visitor center, ruins and campground.

Figure 2. USGS Topographical Map of El Morro National Monument, 2001. Random sample points, distributed according to habitat, slope, elevation and aspect, are indicated by a dot.

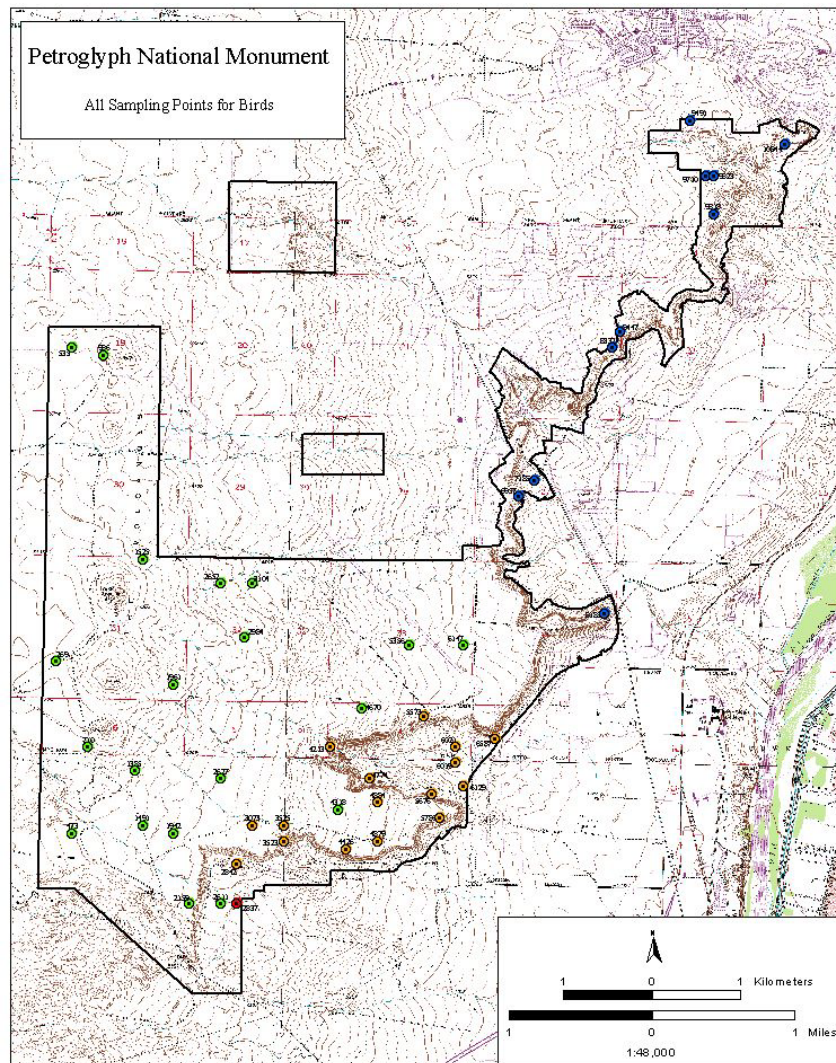


Petroglyph National Historic Monument

At Petroglyph NM, 100 random points were generated and stratified according to habitat, slope, elevation and aspect (Figure 3). Those points which fell on a steep inaccessible slope were moved whenever possible to nearby, contiguous terrain. Three main habitat types were identified: grassland, chaparral and urban vegetation. Using the random sample points, three transects were established, each with 10 point count stations.

Random points were used whenever possible; selection of points was based on accessibility and survey-ability. Non-random points were established to fill in “gaps” between random points (i.e., random points were >500 m apart). All point count stations were located 250 meters apart with a 200 meter buffer between habitat types.

Figure 3. USGS Topographical Map of Petroglyph National Monument, 2001. Random sample points, distributed according to habitat, slope, elevation and aspect, are indicated by a dot.



Salinas Pueblo Missions National Monument

Salinas Pueblo NM consists of three separate sites: Abo, Quarai and Gran Quivira. Due to the small size of each site, no random points or selected point counts were generated.

Riparian and pinyon/juniper are the main habitat types, and we established transects in both. We established one transect with seven points in the riparian habitat at the Abo site, and conducted an area search survey in the riparian habitat at the Quarai site. No riparian habitat exists at the Gran Quivira site. We established three transects in the pinyon/juniper habitats, one at the Abo site (with seven points) and two at the Gran Quivira site (with six points each). All point count stations were located 250 meters apart with a 200 meter buffer between habitat types.

Area searches were conducted in and around the ruins at each site. Due to its small size, we were unable to set up transects at the Quarai site; therefore, area search surveys were conducted to cover the entire site.

Yucca House National Monument

The main habitat types at YUHO are pinyon/juniper and desert scrub (which is dominated by sage brush and cheatgrass). Small patches of riparian habitat occur in the monument. Due to its small size, no random points were generated. Instead, point count stations were established to survey the dominant habitat types. We established two transects in pinyon/juniper habitat, one with 10 points and the other with four points. One transect with 10 points was set up in the desert scrub habitat. Within the riparian zones, we established a transect along a small patch of willow (with four points) and one along an irrigation ditch (with 12 points).

All point count stations were located 250 meters apart with a 200 meter buffer between habitat types.

Area searches were conducted to survey other habitats that were too small for transects. We conducted these surveys in and around the ruins, which was a desert scrub habitat type.

RESULTS

All Parks were visited between 15 May and 15 July on at least three occasions during the 2001 field season, and up to a maximum of four visits.

Table 1. Southern Colorado Plateau National Park Service avian inventory summary of 2001 breeding birds.

National Park Years completed	No. of Breeding Species Detected	No. of Additional Species Detected	Species of Concern	Habitats Surveyed	Bird Habitat of Concern
Aztec Ruin N.M., NM 2001	2001 – 53	No previous inventory	*Yellow-billed Cuckoo	Riparian Desert Scrub	Riparian
El Morro N.M., NM 2001	2001 – 58	9	*Gray Vireo	Deciduous PJ Pinyon/Juniper Grassland	Grassland
Petroglyph N.M., NM 2001	2001 – 41	13	No Species of Concern	Chaparral Grassland Urban Veg	Grassland
Salinas Pueblo Missions N.M., NM 2001	2001 – 63	14	No Species of Concern	Pinyon/Juniper Riparian Desert Scrub	Riparian
Yucca House N.M., CO 2001	2001 – 72	28	*Peregrine Falcon Willow Flycatcher	Pinyon/Juniper Riparian Desert Scrub Willow/Scrub	Riparian Scrub (sage brush)

* State of Colorado or New Mexico Sensitive Bird Species

Aztec Ruins National Monument AZRU

During the 2001 breeding season between 19 May and 10 July, 4 point count surveys were conducted in two habitat types (riparian and upland). Four area search surveys were also completed with an emphasis in habitat that was not adequately covered in point count surveys. Crepuscular and nighttime owl surveys were also completed; however, no species were detected during these surveys. Based on available habitat, it is possible that night surveys conducted earlier in the breeding season might reveal additional species of owls breeding in the monument.

Efforts at AZRU resulted in detecting 321 birds of 43 species during point count surveys and 284 birds of 40 species during area search surveys (Tables 2, 2b). Ten species were detected only during area search surveys. No U.S. Fish and Wildlife Service (USFWS) species of concern were detected; however, one State of New Mexico species of concern was detected, the Yellow-billed Cuckoo.

Species Distribution

Of the 53 species detected during point count and area search surveys, 22 species were detected in both riparian and upland habitat types, while the remaining 27 species were detected in only one habitat type (Tables 2a, 2b). Point count observations found 51% of all detections were noted in riparian habitats, and 49% in upland habitats. This may indicate that many of the bird species breeding at AZRU may not have specific habitat requirements. This may be due in part to the small size of the monument and that most species are distributed throughout, utilizing the entire monument during the breeding season.

Table 2a. Species and number of birds detected in upland and riparian habitats during point count surveys at Aztec Ruins National Monument, May – July 2001.

	Species	HABITAT		Total
		Upland	Riparian	
1	Black-billed Magpie BBMA	17	12	29
2	Blue Grosbeak BGBK	11	13	24
3	Western Meadowlark WEME	10	12	22
4	House Finch HOFI	13	6	19
5	Bullock's Oriole BUOR	14	5	19
6	Black-chinned Hummingbird BCHU	13	5	18
7	European Starling EUST	6	10	16
8	Mourning Dove MODO	8	4	12
9	Black-headed Grosbeak BHGR	1	11	12
10	Red-winged Blackbird RWBL		10	10
11	Killdeer KILL	1	9	10
12	Cliff Swallow CLSW	4	6	10
13	Lesser Goldfinch LEGO		9	9
14	Lark Sparrow LASP	9		9
15	Brown-headed Cowbird BHCO	3	6	9
16	American Robin AMRO	1	6	7
17	Northern Rough-winged Swallow NRWS	5	1	6
18	Lazuli Bunting LABU	2	4	6
19	House Sparrow HOSP	6		6
20	Gamble's Quail GAQU	6		6
21	Canada Goose CAGO		6	6
22	Bewick's Wren BEWR	3	2	5
23	Ash-throated Flycatcher ATFL	4	1	5
24	Violet-green Swallow VGSW	4		4
25	Black-capped Chickadee BCCH*	1	3	4
26	Barn Swallow BARS	2	2	4
27	Northern Flicker NOFL	2	1	3
28	Mallard MALL	2	1	3
29	Cassin's Kingbird CAKI		3	3
30	Yellow Warbler YWAR	1	1	2

31	Yellow-billed Cuckoo YBCU		2	2
32	Western-wood Pewee WWPE		2	2
33	Western Kingbird WEKI	2		2
	Unknown UNKN		2	2
34	Spotted Sandpiper SPSA		2	2
35	Ring-necked Pheasant RNPH	1	1	2
36	Common Raven CORA	1	1	2
37	American Kestrel MAKE	1	1	2
38	Western Bluebird WEBL*	1		1
	Unknown Bluebird UNBL		1	1
39	Turkey Vulture TUVU	1		1
40	Greater Roadrunner GRRO		1	1
41	Eastern Meadowlark EAME		1	1
42	Common Yellowthroat COYE		1	1
43	Black-throated Sparrow BTSP	1		1
	Total number of individuals	157	164	321
	Total number of species			

* Probable Migrant

Table 2b. Species and number of birds observed during area search surveys at Aztec Ruins National Monument, May – July 2001.

Species	HABITAT			Total
	Flyover	Riparian	Upland	
European Starling EUST		34		34
Bullock's Oriole BUOR	1	31	2	34
House Sparrow HOSP		10	10	20
American Robin AMRO		20		20
Black-headed Grosbeak BHGR		8	13	21
Black-billed Magpie BBMA		18		18
Morning Dove MODO		1	10	11
Canada Goose CAGO		11		11
Black-chinned Hummingbird BCHU	2	7	2	11
Bewick's Wren BEWR	1	8	1	10
Gambel's Quail GAQU			9	9
Mallard MALL		8		8
Western Meadowlark WEME			7	7
Northern rough-winged Swallow NRWS	7			7
Red-winged Blackbird RWBL		6		6
Violet-green Swallow VGSW	5			5
Lesser Goldfinch LEGO		5		5
Northern Flicker NOFL		4		4
House Finch HOFI		1	3	4
Black-capped Chickadee BCCH*		2	2	4
American Kestrel MAKE		2	2	4
Lazuli Bunting LABU		2	1	3

44	American Crow AMCR		3		3
	Western-wood Pewee WWPE		2		2
	Western Kingbird WEKI		2		2
45	Great-horned Owl GHOW			2	2
46	Evening Grosbeak EVGR*		2		2
	Ash-throated Flycatcher ATFL			2	2
	Yellow Warbler YWAR		1		1
47	Yellow-rumped Warbler YRWA*		1		1
48	Wilson Warbler WIWA		1		1
	Unknown UNKN		1		1
	Unknown Hawk UNHA		1		1
	Unknown Empidonax UNEM		1		1
	Turkey Vulture TUVU			1	1
49	Say's Phoebe SAPH			1	1
	Ring-necked Pheasant RNPH			1	1
50	Prairie Falcon PRFA	1			1
51	Mountain Chickadee MOCH*		1		1
	Killdeer KILL		1		1
52	Juniper Titmouse JUTI			1	1
53	Chipping Sparrow CHSP*			1	1
	Brown-headed Cowbird BHCO		1		1
	TOTAL	17	196	71	284

* Probable Migrant

Species Richness

A total of 53 species were detected at AZRU during the 2001 breeding season. This number includes the point count, area search and nocturnal surveys. Of the total 53 species detected, 42 were in riparian habitats, 14 of which were only detected in riparian zones. Thirty-seven species were detected in upland habitat, 12 of which were only found in uplands. (Tables 2a, 2b).

Species-Effort Relationship and Jackknife Estimators

The results of the species-effort relationships for the two areas are shown in Table 2c. In Table 2c, the second column shows the number of samples (points) where the mean dissimilarity in assemblages falls below 10%, where the curve flattens out. The third column shows the average number of species detected in that area. The last column shows the average number of species detected (species-effort) as a percentage of the actual number of observed species. In the riparian habitat the curve flattens out at 4 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 35.0. When the curve flattens out the average number of species detected is 100% of the actual number of observed species. In the upland habitat the curve flattens out at 6 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number

of species detected was 31.4. When the curve flattens out the average number of species detected is 95 % of the actual number of observed species. These figures give us a reliable estimate that we have well exceeded the effort of work needed to identify at least 90% of the species present in both the riparian and upland habitats where point counts were conducted.

Table 2c. Species-effect relationships data for the two habitat types at Aztec Ruins National Monument during breeding season 2001.

	No. of points – mean dissimilarity < 10%	Average No. of species detected	Percent of observed species
Riparian	4	35.0	100
Upland	6	30.6	95

Jackknife estimates provide estimates of the true number of species by generating a frequency distribution by repeatedly sampling the distribution of species among samples. The first-order jackknife estimates are shown in Table 2d. The riparian habitats showed the greatest differences while the upland habitats showed intermediate differences. Overall, our surveys detected the common species and that further surveying may detect the rare and inconspicuous species.

Table 2d. Comparison of observed number of species and first-order jackknife estimates for the two habitat types at Aztec Ruins National Monument during breeding season 2001.

	Number of Observed Species	Jackknife Estimate	% Increase of Estimate from Observed
Riparian	35	46.3	24.4
Upland	33	42.4	22.6

El Morro National Monument

During the 2001 breeding season, three point count surveys were conducted in three habitat types (grassland, deciduous pinyon/juniper, and pinyon/juniper) (Table 3a). Three area search surveys were also completed with an emphasis in habitat that was not adequately covered in point count surveys (e.g, cliffs, deciduous pinyon/juniper, pinyon/juniper, scrub and riparian) (Table 3b). Two crepuscular and nighttime surveys were completed in addition.

At El Morro National Monument, we detected 514 birds of 50 species during point count surveys (Table 3a). Area search surveys detected 178 birds of 48 species; 8 species were detected that were not observed in point count surveys (Table 3b). Night-time and crepuscular surveys detected a Great-horned Owl. Based on available habitat, it is possible that nighttime surveys conducted earlier in the breeding season might reveal additional species of owls breeding in the monument. No U.S. Fish and Wildlife Service (USFWS) or state species of concern were detected; however one New Mexico Sensitive Bird Species was detected, the Gray Vireo (*Vireo vicinior*).

Species Distribution

Of the 50 species detected during point count surveys at El Morro, only 12 species were detected in all three habitat types, 18 species were detected in two habitat types, and 28 species were detected in only one habitat type (Tables 3a, 3b). Point count observations found 45.3 % of all detections were noted in deciduous pinyon/juniper, 31.9% in grassland and 22.8 % in pinyon/juniper habitats. This may indicate that many of the bird species breeding at El Morro have specific habitat requirements, such as pinyon/juniper, and seem to be quite abundant in patches of that habitat type.

Table 3a. Species and number of bird detected per habitat during point count surveys at El Morro National Monument, May–July 2001.

	SPECIES	HABITAT			Total
		Deciduous P/J	Grassland	Pinyon/Juniper	
1	Chipping Sparrow CHSP	10	16	20	46
2	White-throated Swift WTSW	37	1		38
3	Lark Sparrow LASP		21	14	35
4	Ash-throated Flycatcher ATFL	15	6	13	34
5	Western Meadowlark WEME	3	23	3	29
6	Common Raven CORA	15	8	5	28
7	Spotted Towhee SPTO	5	10	7	22
8	Pinyon Jay PIJA	2	15	3	20
9	Western Bluebird WBL	17		2	19
10	Morning Dove MODO	5	10	4	19
11	Western Scrub Jay WESJ	3	7	8	18
12	Mountain Chickadee MOCH	9		7	16
13	Western-wood Pewee WWPE	13	1		14
14	Green-tailed Towhee GTTO		12	2	14
15	Northern Flicker NOFL	11	1	1	13
16	Vesper Sparrow VESP		10	1	11
17	Cassin's Kingbird CAKI	1	8	2	11
18	Bewick's Wren BEWR		4	7	11
19	Violet-green Swallow VGSW	10			10
20	White-breasted Nuthatch WBNU	7	1	1	9
21	Pygmy Nuthatch PYNU	6		1	7
22	Cliff Swallow CLSW	7			7
23	American Kestrel AMKE	6		1	7
	Unknown UNKN	2	2	2	6
24	Western Tanager WETA	5			5
25	Say's Phoebe SAPH	4	1		5
26	Lewis Woodpecker LEWO	5			5
27	Juniper Titmouse JUTI	1		4	5
28	Hepatic Tanager HETA	3	1	1	5
29	Black-chinned Hummingbird BCHU	4		1	5
30	American Robin AMRO	3		2	5

31	Canyon Wren CANW	4			4
32	Northern Mockingbird NOMO		2	1	3
33	House Finch HOFI	2		1	3
34	Cordilleran Flycatcher COFL	3			3
35	Black-headed Grosbeak BHGR	2		1	3
36	Rock Wren ROWR	2			2
37	Common Bushtit COBU	2			2
38	American Crow AMCR	1		1	2
39	Wilson Warbler WIWA	1			1
	Unknown Woodpecker UNWO	1			1
40	Tree Swallow TRSW	1			1
41	Red-wing Bluebird RWBL	1			1
42	Mountain Bluebird MOBL	1			1
43	MacGillivray's Warbler MACW	1			1
44	Grace Warbler GRWA	1			1
45	Gray Vireo GRVI	1			1
46	Gambel's Quail GAQU		1		1
47	Bullock's Oriole BUOR			1	1
48	Black-throated Sparrow TSP		1		1
49	Broad-tailed Hummingbird BTHU		1		1
50	Brown-headed Cowbird BHCO		1		1
	Total number of individuals	233	164	117	514
	Total number of species				

Table 3b. Species and number of birds observed during area search surveys at El Morro National Monument, May – July 2001. Those in bold were not detected in point count surveys.

	SPECIES	HABITAT					Total
		Cliff	Deciduous P/J	Pinyon/Juniper	Scrub	Riparian	
	House Finch HOFI		5	1		12	18
	White-breasted Nuthatch WBNU		6	5			11
	Violet-green Swallow VGSW		8	1			9
	Morning Dove MODO		4	1		4	9
	Lark Sparrow LASP			5	2	1	8
	Ash-throated Flycatcher ATFL		5	3			8
	Rock Wren ROWR	5	1	1			7
	White-throated Swift WTSW		6				6
	Western Meadowlark WEME		2	4			6
	Wilson's Warbler WIWA		5				5
	Western Bluebird WEBL		4	1			5
	Mountain Chickadee MOCH		4	1			5
	Black-chinned Hummingbird BCHU		2			3	5
	Western-wood Pewee WWPE		4				4
	Spotted Towhee SPTO		2	2			4
	Mountain Bluebird MOBL			4			4
	Lewis Woodpecker LEWO		4				4

51	Common Nighthawk CONI				4		4
	Cassin's Kingbird CAKI			2	2		4
	American Robin AMRO		3	1			4
	American Kestrel AMKE		2	2			4
	Say's Phoebe SAPH		1	1	1		3
	Northern Flicker NOFL			3			3
	Green-tailed Towhee GTTO			3			3
	Cliff Swallow CLSW		2	1			3
	Broad-tailed Hummingbird BTHU		2	1			3
52	Western Kingbird WEKI		2				2
	Juniper Titmouse JUTI		1	1			2
	Hepatic Tanager HETA		1	1			2
	Brown-headed Cowbird BHCO				2		2
	Bewick's Wren BEWR		2				2
53	Acorn Woodpecker ACWO			2			2
54	Prairie Falcon PRFA	1					1
	Western Scrub Jay WESJ		1				1
55	Warbling Vireo WAVI		1				1
	Unknown UNKN		1				1
	Northern Mockingbird NOMO					1	1
	MacGillivray's Warbler MACW		1				1
56	Horned Lark HOLA	1					1
	Gray Vireo GRVI		1				1
57	Great-horned Owl GHOW			1			1
58	Dusky Flycatcher DUFL		1				1
	Common Raven CORA		1				1
	Cordilleran Flycatcher COFL		1				1
	Chipping Sparrow CHSP			1			1
	Canyon Wren CANW		1				1
	Bullock's Oriole BUOR		1				1
	Black-throated Sparrow BTSP					1	1
	Black-headed Grosbeak BHGR		1				1
	TOTAL	7	89	49	11	22	178

Species Richness

A total of 58 species were detected at ELMO during the 2001 breeding season; point count surveys detected 50 species, and area search and nocturnal surveys detected an additional eight species.

Of the 58 species detected, 40 were in deciduous pinyon/juniper habitat, of which 16 species were detected only in this habitat. Twenty-four species were detected in grassland habitats, of which 4 were found exclusively in grassland. Twenty-nine species were detected in pinyon/juniper habitat, of which only one of these species was found exclusively in pinyon/juniper (Tables 3a, 3b).

During area search surveys, we observed three species in the cliffs, of which two species were only detected there. Five species were detected scrub habitats, of which one species (Common Nighthawk) was only detected there. Six species were detected in the riparian habitats, of which 2 species (Northern Mockingbird and Black-throated Sparrow) were found there exclusively; both the Northern Mockingbird and Black-throated Sparrow are upland species that can be found in riparian areas later in the breeding season (Johnson et al. in press).

Species-Effort Relationship and Jackknife Estimators

The results of the species-effort relationships for the two areas are shown in Table 3c. In Table 3c, the second column shows the number of samples (points) where the mean dissimilarity in assemblages falls below 10%, where the curve flattens out. The third column shows the average number of species detected in that area. The last column shows the average number of species detected (species-effort) as a percentage of the actual number of observed species. In the deciduous pinyon/juniper habitat the curve flattens out at 7 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 38.4. When the curve flattens out the average number of species detected is 96 % of the actual number of observed species. These figures give us a reliable estimate of effort of work needed to identify at least 90% of the species present in both the deciduous pinyon/juniper, grassland and pinyon/juniper and in each habitat type we are well above the 90% level.

Table 3c. Species-effect relationships data for the three habitat types at El Morro National Monument during breeding season 2001.

	# of points – mean dissimilarity < 10%	Average # of species detected	Percent of observed species
Deciduous P/J	7	38.4	96
Grassland	6	22.6	94
Pinyon/Juniper	5	25.7	92

Jackknife estimates provide estimates of the true number of species by generating a frequency distribution by repeatedly sampling the distribution of species among samples. The first-order jackknife estimates are shown in Table 3d. The pinyon/juniper and grassland habitat showed the greatest differences while the deciduous pinyon/juniper habitats showed intermediate differences. Overall, our surveys detected the common species and that further surveying may detect the rare and inconspicuous species.

Table 3d. Comparison of observed number of species and first-order jackknife estimates for the three habitat types at El Morro National Monument during breeding season 2001.

	Number of Observed Species	Jackknife Estimate	% Increase of Estimate from Observed
Deciduous P/J	40	51.4	22.2
Grassland	24	32.6	26.4
Pinyon/Juniper	28	39.7	29.5

Petroglyph National Monument

During the 2001 breeding season, point count surveys were conducted in four habitat types (i.e., grassland, desert scrub, chaparral and urban vegetation) at Petroglyph National Monument (PETR). Four area search surveys were also completed with an emphasis in habitat that was not adequately covered in point count surveys. Additionally, two crepuscular and nighttime surveys were completed.

At PETR, we detected 1164 birds of 36 species during point count surveys and 85 birds of 27 species during area search surveys (Tables 4a, 4b). Five species were detected during area search surveys that were not detected during point counts. No species were detected during crepuscular and nocturnal surveys. Based on available habitat, it is possible that night surveys conducted earlier in the breeding season might reveal species of owls breeding in the monument. There were no U.S. Fish and Wildlife Service (USFWS) species of concern detected.

Species Distribution

Of the 36 species detected during point count surveys at PETR, 16 species were detected in all three habitats, 5 species were detected in only two habitats, and 15 species were detected in only one habitat type (Table 4a). Point count observations found 24.7 % of all detections were noted in chaparral, 28.2 % in grassland and 47.1 % in urban vegetation. This may indicate that almost half of the bird species breeding at PETR occupy urban habitat due to urbanization of the surrounding area that has modified species distribution within and near the monument.

Table 4a. Species and number of birds detected per habitat during point count surveys at Petroglyph National Monument, May–July 2001.

No.	SPECIES	HABITAT			TOTAL
		Chaparral	Grassland	Urban Veg	
1	Horned Lark HOLA	56	156	5	217
2	Morning Dove MODO	38	8	80	126
3	House Finch HOFI	21	10	61	92
4	House Sparrow HOSP	19		67	86
5	Rock Wren ROWR	20	25	36	81
6	Eastern Meadowlark EAME	24	52	1	77
7	Cliff Swallow CLSW	6	6	42	54
8	Black-chinned Hummingbird BCHU	12	6	34	52
9	Northern Rough-wing Swallow NRWS			41	41
10	Northern Mockingbird NOMO	7	8	23	38
11	Black-throated Sparrow BTSP	19	14	2	35
12	Rock Dove RODO			35	35
13	Scaled Quail SCQU	5	3	19	27
15	Western Meadowlark WEME	2	4	17	23
16	Say's Phoebe SAPH	3	1	17	21

17	Western Kingbird WEKI	4	3	14	21
18	Barn Swallow BASW	1	7	12	20
19	Canyon Wren CAWR	4	4		8
20	Unknown UNKN	3	2	2	6
21	Brown-headed Cowbird BHCO	5			5
22	Bullock's Oriole BUOR			5	5
23	Greater Roadrunner GRRO			5	5
24	Lark Sparrow LASP	4		1	5
25	Common Nighthawk CONI	4			4
26	Lesser Goldfinch LEGO	1	1	2	4
27	American Kestrel AMKE		1	1	2
28	American Robin AMRO	1		1	2
29	Blue Grosbeak BGBK			2	2
30	Common Raven CORA			2	2
	Unknown Kingbird UNKI			2	2
	Unknown Swallow UNSW		2		2
	Unknown Towhee UNTO	2			2
	Unknown Hummingbird UNHU			1	1
31	Brewer's Sparrow BRSP	1			1
32	Chipping Sparrow CHSP*			1	1
33	Cooper's Hawk COHA			1	1
34	European Starling EUST			1	1
35	Ladder-back Woodpecker LBWO	1			1
36	Red-tailed Hawk RTHA			1	1
	Total number of individuals	288	328	548	1164
	Total number of species				

* Probable Migrant

Table 4b. Species and number of birds observed during area search surveys at Petroglyph National Monument, May – July 2001. Those in bold were not detected in point count surveys.

No.	Species	HABITAT			TOTAL
		Chaparral	Grassland	Urban Veg	
	Barn Swallow BASW			14	14
	Black-chinned Hummingbird BCHU			12	12
	Horned Lark HOLA		10		10
	Rock Wren ROWR			7	7
	Morning Dove MODO	3		3	6
	Scaled Quail SCQU			6	6
	Black-throated Sparrow BTSP	5			5
	Northern Mockingbird NOMO	4			4
	Say's Phoebe SAPH		4		4
	Common Nighthawk CONI	3			3
37	Gambel's Quail GAQU			3	3
	Western Kingbird WEKI			3	3
	Cassin's Kingbird CAKI			2	2

	Greater Roadrunner GRRO	2		2
	House Finch HOFI		2	2
	Mountain Chickadee MOCH*	2		2
	Unknown Hummingbird UNHU		2	2
38	American Crow AMCR		1	1
	American Robin AMRO		1	1
	Black-headed Cowbird BHCO		1	1
	Bullock's Oriole BUOR		1	1
	Canyon Wren CANW	1		1
39	Common Poorwill COPO	1		1
	Common Raven CORA		1	1
40	Green-tailed Towhee GTTO	1		1
	Lark Sparrow LASP	1		1
41	Swainson's Hawk SWHA	1		1
	Unknown UNKN	1		1
	Western Meadowlark WEME	1		1
	TOTAL	19	21	45
			85	

* Probable Migrant

Species Richness

A total of 41 species were detected at PETR during the 2001 breeding season; point count surveys detected 36 species, and area search surveys detected an additional 5 species. In chaparral habitat, 25 species were detected, 5 of which were found only in this habitat. In grassland habitats, 20 species were detected, two of which were found only there. In urban vegetation habitats, 32 species were detected, 12 of which were detected only in these urban transects (Tables 4a, 4b).

Species-Effort Relationship and Jackknife Estimators

The results of the species-effort relationships for the two areas are shown in Table 4c. In Table 2 the second column shows the number of samples (points) where the mean dissimilarity in assemblages falls below 10%, where the curve flattens out. The third column shows the average number of species detected in that area. The last column shows the average number of species detected (species-effort) as a percentage of the actual number of observed species. In the Chaparral habitat the curve flattens out at 8 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 22.5. When the curve flattens out the average number of species detected is 93 % of the actual number of observed species. These figures give us a reliable estimate of effort of work needed to identify at least 90% of the species present in chaparral, grassland and urban development habitats.

Table 4c. Species-effect relationships data for the three habitat types at Petroglyph National Monument during breeding season 2001.

	# of points – mean dissimilarity < 10%	Average # of species detected	Percent of observed species
Chaparral	8	22.5	93
Grassland	7	16.4	91
Urban Vegetation	8	27.7	92

Jackknife estimates provide estimates of the true number of species by generating a frequency distribution by repeatedly sampling the distribution of species among samples. The first-order jackknife estimates are shown in Table 4d. The urban habitat showed the greatest differences while the grassland and chaparral habitats showed intermediate differences. Overall, our surveys detected the common species and that further surveying may detect the rare and inconspicuous species.

Table 4d. Comparison of observed number of species and first-order jackknife estimates for the three habitat types at Petroglyph National Monument during breeding season 2001.

	Number of Observed Species	Jackknife Estimate	% Increase of Estimate from Observed
Chaparral	24	30.3	20.8
Grassland	18	21.6	16.7
Urban Vegetation	30	39.9	24.8

Salinas Pueblo Missions National Monument

During the 2001 breeding season, four point count surveys were conducted, three in pinyon/juniper and one in riparian habitat. Four area search surveys were also completed with an emphasis in habitat that was not adequately covered in point count surveys, particularly desert scrub. Additionally, three crepuscular and nighttime surveys were completed.

At SAPU, we detected 682 birds of 40 species during point count surveys (Table 5a). Area search surveys detected 467 birds of 56 species, 23 of which were not detected in point count surveys (Table 5b). Night-time and crepuscular surveys detected the presence of two additional species, Common Poorwill and Great-horned Owl. Based on available habitat, it is possible that night surveys conducted earlier in the breeding season might reveal additional species of owls breeding in the monument. No U.S. Fish and Wildlife Service (USFWS) species of concern were detected.

Species Distribution

Of the 63 species detected at Salinas Pueblo, 22 were in both habitat types, while 19 species were detected in only one habitat type (Table 5). Point count observations found 70.2 % of all detections were noted in pinyon/juniper habitat, 29.8 % in riparian.

Riparian habitat accounts for a small portion of the total area of the monument; these patches tend to be associated with structurally complex and diverse understory, all of which are favorable breeding habitat characteristics for many bird species.

Table 5a. Species and number of birds detected per habitat during point count surveys at Salinas Pueblo Missions National Monument, May–July 2001.

	SPECIES	HABITAT		TOTAL
		Pinyon/Juniper	Riparian	
1	Juniper Titmouse JUTI	82	4	86
2	Ash-throated Flycatcher ATFL	53	22	75
3	Spotted Towhee SPTO	50	7	57
4	Bewick's Wren BEWR	52		52
5	Chipping Sparrow CHSP	42	9	51
6	Morning Dove MODO	32	11	43
7	Rock Wren ROWR	12	19	31
8	Blue Grosbeak BGBK	6	24	30
9	Cassin's Kingbird CAKI	13	13	26
10	House Finch HOFI	13	11	24
11	Western Scrub Jay WESJ	20	1	21
12	Cliff Swallow CLSW	5	14	19
13	Lark Sparrow LASP	11	7	18
14	Pinyon Jay PIJA	11	6	17
15	Common Bushtit COBU	14	3	17
16	Lesser Goldfinch LEGO	4	12	16
17	Common Raven CORA	12	3	15
18	Say's Phoebe SAPH	4	7	11
19	Brown-headed Cowbird BHCO	3	6	9
20	Common Nighthawk CONI	7	1	8
21	Black-chinned Hummingbird BCHU	4	4	8
22	Western Bluebird WEBL	3	2	5
23	American Robin AMRO	5		5
24	Western Meadowlark WEME	3		3
	Unknown UNKN	3		3
25	Turkey Vulture TUVU	3		3
26	Ladder-backed Woodpecker LBWO	2	1	3
27	Black Phoebe BLPH		3	3
	Unknown Woodpecker UNWO	1	1	2
28	Brown Towhee BRTO		7	7
29	Burrowing Owl BUOR		2	2
30	Black-headed Grosbeak BHGR	2		2
31	Violet-green Swallow VGSW	1		1
32	Northern Rough-winged Swallow NRWS		1	1
33	Gray Flycatcher GRYF	1		1
34	Gamble's Quail GAQU	1		1

35	Cooper's Hawk COHA	1		1
36	Black-throated Sparrow BTSP	1		1
37	Blue-gray Gnatcatcher BGGN		1	1
38	American Crow AMCR		1	1
39	American Coot AMCO	1		1
40	Ash-throated Flycatcher AFTL	1		1
	Total number of individuals	479	203	682
	Total number of species			

Table 5b. Species and number of birds observed during area search surveys at Salinas Pueblo Missions National Monument, May – July 2001. Those in bold were not detected in point count surveys.

	SPECIES	HABITAT			TOTAL
		Desert Scrub	Pinyon/ Juniper	Riparian	
41	Band-tailed Pigeon BTPI		18	33	51
	Violet-green Swallow VGSW	4	27	10	41
	Juniper Titmouse JUTI	1	27	1	29
	House Finch HOFI	10	6	11	27
	Western Bluebird WEBL		16	3	19
	Blue Grosbeak BGBK		6	13	19
	Morning Dove MODO		6	11	17
	Lesser Goldfinch LEGO		8	8	16
42	Yellow-breasted Chat YBCH		3	11	14
	Spotted Towhee SPTO		9	5	14
	Rock Wren ROWR	2	4	8	14
	Bullock's Oriole BUOR	4	4	6	14
	Black-head Grosbeak BHGR	1	5	8	14
43	Western-wood Pewee WWPE		6	6	12
	Western Scrub Jay WESJ		7	5	12
	Brown-headed Cowbird BHCO		3	9	12
	Black-chinned Hummingbird BCHU		5	6	11
	Ash-throated Flycatcher ATFL		4	5	9
44	Western Tanager WETA		6	1	7
45	MacGillivray's Warbler MACW			7	7
	Brown Towhee BRTO		2	5	7
	American Robin AMRO		2	5	7
46	Northern Mockingbird NOMO	2	1	3	6
	Ladder-backed Woodpecker LBWO	2	1	3	6
	Gamble's Quail GAQU	1	1	4	6
	Turkey Vulture TUVU	1	3	1	5
47	Wilson's Warbler WIWA			4	4
	Unknown Accipiter UNAC			4	4
48	Great-horned Owl GHOW	2	2		4
	Common Raven CORA	1	2	1	4
	Cassin's Kingbird CAKI			4	4

49	Barn Swallow BARS		4		4
	Say's Phoebe SAPH	1	1	1	3
50	Plumbeous Vireo PLVI		2	1	3
	Pinyon Jay PIJA		1	2	3
51	Northern Flicker NOFL	1	1	1	3
	Common Nighthawk CONI		3		3
	Chipping Sparrow CHSP		2	1	3
	Bewick's Wren BEWR	1	2		3
52	White-crowned Sparrow WCSP			2	2
53	White-breasted Nuthatch WBNU		2		2
	Unknown Empidonax UNEM			2	2
54	Red-tailed Hawk RTHA		1	1	2
	Cliff Swallow CLSW		2		2
55	Broad-tailed Hummingbird BTHU		1	1	2
	Black Phoebe BLPH			2	2
56	Yellow Warbler YWAR			1	1
57	Virginia's Warbler VIWA		1		1
58	Scaled Quail SCQU		1		1
59	Mountain Bluebird MOBL		1		1
60	Mallard MALL			1	1
61	House Wren HOWR			1	1
	Gray Flycatcher GRYF			1	1
62	Common Poorwill COPO		1		1
	Cooper's Hawk COHA		1		1
	Common Bushtit COBU		1		1
63	Black-throated Gray Warbler BTGW			1	1
	Blue-gray Gnatcatcher BGGN			1	1
	TOTAL	34	212	221	467

Species Richness

A total of 63 species were detected at SAPU during the 2001 breeding season. This number includes the point count, area search and nocturnal surveys. In pinyon/juniper habitats, 51 species were detected, 18 of which were only detected in this habitat. In riparian habitats, 44 species were detected, 14 of which were only found in that habitat. Three additional species were detected by area search surveys in desert scrub habitats; these three species were also detected in other habitats surveyed (Tables 5a, 5b).

Species-Effort Relationship and Jackknife Estimators

The results of the species-effort relationships for the two areas are shown in Table 5c. In Table 5c the second column shows the number of samples (points) where the mean dissimilarity in assemblages falls below 10%, where the curve flattens out. The third

column shows the average number of species detected in that area. The last column shows the average number of species detected (species-effort) as a percentage of the actual number of observed species. In the pinyon/juniper habitat the curve flattens out at 12 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 30.3. When the curve flattens out the average number of species detected in pinyon/juniper is 89% of the actual number of observed species. In the riparian habitat the curve flattens out at 6 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 27.3. When the curve flattens out the average number of species detected in the riparian is 94% of the actual number of observed species. These figures give us a reliable estimate of effort of work needed to identify at least 90% of the species present in both the pinyon/juniper and riparian habitats.

Table 5c. Species-effect relationships data for the two habitat types at Salinas Pueblo Missions National Monument during breeding season 2001.

	# of points – mean dissimilarity < 10%	Average # of species detected	Percent of observed species
Pinyon/Juniper	12	30.3	89
Riparian	6	27.3	94

Jackknife estimates provide estimates of the true number of species by generating a frequency distribution by repeatedly sampling the distribution of species among samples. The first-order jackknife estimates are shown in Table 5d. The riparian habitats showed the greatest differences while the pinyon/juniper habitats showed intermediate differences. Overall, our surveys detected the common species and that further surveying may detect the rare and inconspicuous species.

Table 5d. Comparison of observed number of species and first-order jackknife estimates for the two habitat types at Salinas Pueblo Missions National Monument during breeding season 2001.

	Number of Observed Species	Jackknife Estimate	% Increase of Estimate from Observed
Pinyon/Juniper	34	41.6	18.3
Riparian	29	39.3	26.2

Yucca House National Monument

During the 2001 breeding season, four point count surveys were conducted, one in each of four habitat types (i.e., desert scrub, pinyon/juniper, riparian and willow/scrub) at Yucca House National Monument. Four area search surveys were also completed with an emphasis in habitat that was not adequately covered in point count surveys. Additionally, crepuscular and nighttime surveys were completed.

At YUHO, we detected 1457 birds of 68 species during point count surveys (Table 6a). Area search surveys detected 232 birds and four additional species that were not detected in point count surveys (Table 6b). Night-time and crepuscular surveys did not result in the detection of any additional species. Based on available habitat, it is possible that night surveys conducted earlier in the breeding season might reveal species of owls breeding in the monument. The Willow Flycatcher, a U.S. Fish and Wildlife Service (USFWS) species of concern, was detected, and a Colorado state species of concern was detected, the Peregrine Falcon (*Falco peregrinus anatum*).

Species Distribution

Of the 72 species detected, 24 species were detected in all four habitat types, 8 were detected in three habitats, 13 were detected in two habitats, and 27 species were detected in only one habitat type (Tables 6a, 6b). Point count observations found 21% of all detections were noted in desert scrub, 29% in pinyon/juniper, 37% in riparian and 13% in willow/scrub habitats. This may indicate that many of the bird species breeding at YUHO may not have specific habitat requirements. This may be due in part to the small size of the monument and that most species are distributed throughout, utilizing the entire monument during the breeding season.

Table 6a. Species and number of birds detected per habitat during point count surveys at Yucca House National Monument, May–July 2001.

	SPECIES	HABITAT				TOTAL
		Desert Scrub	Pinyon/juniper	Riparian	Willow/Scrub	
1	Spotted Towhee SPTO	27	42	45	28	142
2	Lesser Goldfinch LEGO	15	17	48	11	91
3	Juniper Titmouse JUTI	13	39	18	7	77
4	Lark Sparrow LASP	19	17	33	4	73
5	Black-chinned Hummingbird BCHU	18	24	13	6	61
6	Mourning Dove MODO	21	15	19	5	60
7	Western Meadowlark WEME	15	7	31	6	59
8	Pinyon Jay PIJA	11	46		1	58
9	Bullock's Oriole BUOR	12	4	31	7	54
10	Bewick's Wren BEWR	10	19	13	11	53
11	Black-throated Sparrow BTSP	19	29	1	1	50
12	House Finch HOFI	12	9	21	4	46
13	Ash-throated Flycatcher ATFL	4	15	18	7	44
14	Chipping Sparrow CHSP	2	4	20	15	41
15	Loggerhead Shrike LOSH	16	24			40
16	Brown-headed Cowbird BHCO	7	2	16	15	40
17	Western Scrub Jay WESJ	6	12	15	4	37
18	Western Kingbird WEKI	1	2	34		37
19	Gray Vireo GRVI	10	22	1	4	37
20	Blue Grosbeak BGBK	6	7	22	2	37

21	Blue-gray Gnatcatcher BGGN	12	16	4	3	35
22	Western Wood Pewee WWPE	4	2	17	11	34
23	Common Bushtit COBU	1	1	24	2	28
24	Yellow-breasted Chat YBCH	2	2	11	5	20
25	Gray FlycatcherGRYF	1	6	4	7	18
	Unknown UNKN	9	4	1	2	16
26	Common Raven CORA	5	2	4	4	15
27	Red-winged Blackbird RWBL	2	4	7	1	14
28	Black-billed Magpie BBMA	2	5	7		14
29	American Kestrel AMKE	3	3	7		13
30	White-throated Swift WTSW	1	5			6
31	Ring-necked Pheasant RNPH			5	1	6
32	Violet-green Swallow VGSW	2	3			5
33	Rufous Hummingbird RUHU			1	4	5
34	Lazuli Bunting LABU	1	1	3		5
35	European Starling EUST	1		4		5
36	Common Nighthawk CONI		2	1	2	5
37	Black-headed Grosbeak BHGR		1	2	2	5
38	Western Tanager WETA			4		4
	Unknown Hummingbird UNHU			2	2	4
39	Say's Pheobe SAPH	2		2		4
40	Brewer's Blackbird BRBL	3	1			4
41	Yellow Warbler YWAR	1		1	1	3
42	Willow Flycatcher WIFL			1	2	3
	Unknown Sparrow UNSP	1	1	1		3
43	Northern Mockingbird NOMO		1	2		3
44	Mountain Bluebird MOBL	2	1			3
45	MacGillivray's Warbler MACW			3		3
46	American Robin AMRO		1	2		3
	Unknown Woodpecker UNWO			2		2
47	Plumbeous Vireo PLVI			2		2
48	Mallard MALL			2		2
49	Common Yellowthroat COYE		1	1		2
50	Black-throated Gray Warbler BTGW				2	2
51	Brewer's Sparrow BRSP			2		2
52	American Crow AMCR		2			2
53	Yellow-headed Blackbird YHBL			1		1
54	White-crowned Sparrow WCSP	1				1
55	Warbling Vireo WAVI			1		1
	Unknown Warbler UNWA				1	1
	Unknown Quail UNQU			1		1
	Unknown Oriole UNOR				1	1
	Unknown Flycatcher UNFL				1	1
56	Turkey Vulture TUVU			1		1
57	Song Sparrow SOSP	1				1
58	Scaled Quail SCQU			1		1

59	Red-tailed Hawk RTHA			1		1
60	Rock Wren ROWR		1			1
61	Northern Rough-Winged Swallow NRWS	1				1
62	Northern Flicker NOFL	1				1
63	Killdeer KILL			1		1
64	Great Blue Heron GBHE			1		1
65	Dusky Flycatcher DUFL	1				1
66	Cliff Swallow CLSW		1			1
67	Cassin's Kingbird CAKI		1			1
68	Barn Swallow BARS	1				1
	Total	305	426	536	192	1457

Table 6b. Species observed during area search surveys, May – July 2001. Those species in bold were not detected in the point count surveys.

SPECIES	HABITAT				TOTAL
	Desert Scrub	Pinyon/Juniper	Riparian	Willow/Scrub	
Pinyon Jay PIJA	1	52			53
Brown-headed Cowbird BHCO	6	1	3	1	11
Mourning Dove MODO	8	1		1	10
Common Bushtit COBU		2	4	4	10
Blue Grosbeak BGBK	5		3	2	10
House Finch HOFI	7	1		1	9
Western Meadowlark WEME	7			1	8
Western Kingbird WEKI	8				8
Spotted Towhee SPTO	4	2		1	7
Loggerhead Shrike LOSH	7				7
Lesser Goldfinch LEGO	2	2		3	7
Chipping Sparrow CHSP	2		1	4	7
Black-chinned Hummingbird BCHU	2	3	1	1	7
Mountain Bluebird MOBL		2	4		6
Black-throated Sparrow BTSP	4		2		6
Red-Winged Blackbird RWBL	5				5
Ash-throated Flycatcher ATFL	1	2	2		5
Lark Sparrow LASP	1	2	1		4
Juniper Titmouse JUTI	3		1		4
Gray Vireo GRVI		2	2		4
Bullock's Oriole BUOR	3			1	4
Brewer's Sparrow BRSP	3			1	4
Mallard MALL				3	3
69 House Finch HOSP	3				3
Black-billed Magpie BBMA	2	1			3
Yellow-breasted Chat YBCH			1	1	2
Western Wood Pewee WWPE		1	1		2
White-throated Swift WTSW	2				2

	Say's Phoebe SAPH	2				2
	Common Raven CORA	2				2
	Black-headed Grosbeak BHGR			1	1	2
	Blue-Gray Gnatcatcher BGGN				2	2
	Warbling Vireo WAVI			1		1
	Unknown Woodpecker UNWO	1				1
	Unknown UNKN	1				1
	Unknown Empidonax UNEM				1	1
	Rufous Hummingbird RUHU			1		1
	Red-tailed Hawk RTHA				1	1
	Plumbeous Vireo PLVI			1		1
70	Peregrine Falcon PEFA				1	1
71	Olive-sided Flycatcher OSFL		1			1
72	Northern Harrier NOHA	1				1
	Gray Flycatcher GRYF		1			1
	Common Nighthawk CONI			1		1
	Barn Swallow BARS	1				1
	Total	94	76	31	31	232

Species Richness

A total of 72 species were detected at YUHO during the 2001 breeding season. This number includes the point count, area search and nocturnal surveys. A total of 45 species were detected in desert scrub habitats, of which eight species were detected only in desert scrub. A total of 44 species were detected in pinyon/juniper habitats, of which 5 were found only in pinyon/juniper. A total of 51 species were detected in the riparian habitats, of which 12 species were detected only in riparian. A total of 33 species were detected in the willow/scrub habitats, of which 2 species were detected only that habitat type (Tables 6a, 6b).

Species-Effort Relationship and Jackknife Estimators

The results of the species-effort relationships for the two areas are shown in Table 6c. In Table 2 the second column shows the number of samples (points) where the mean dissimilarity in assemblages falls below 10%, where the curve flattens out. The third column shows the average number of species detected in that area. The last column shows the average number of species detected (species-effort) as a percentage of the actual number of observed species. For example, in the desert scrub habitat the curve flattens out at 8 samples (points), where mean dissimilarity in assemblages was less than 10 percent. At this value the average number of species detected was 39.7. When the curve flattens out the average number of species detected is 92% of the actual number of observed species. These figures give us a reliable estimate of effort of work needed to identify at least 90% of the species present in the desert scrub, pinyon/juniper, riparian, and willow/scrub habitats.

Table 6c. Species-effect relationships data for the four habitat types at Yucca House National Monument during breeding season 2001.

	# of points – mean dissimilarity < 10%	Average # of species detected	Percent of observed species
Desert Scrub	8	39.7	92
Pinyon/juniper	10	40.0	93
Riparian	8	45.7	89
Willow/scrub	4	32.0	100

Jackknife estimates provide estimates of the true number of species by generating a frequency distribution by repeatedly sampling the distribution of species among samples. The first-order jackknife estimates are shown in Table 3. The desert scrub, pinyon/juniper and riparian habitats showed the greatest differences while the willow/scrub habitat showed intermediate differences. Overall, our surveys detected the common species and that further surveying may detect the rare and inconspicuous species.

Table 6d. Comparison of observed number of species and first-order jackknife estimates for the four habitat types at Yucca House National Monument during breeding season 2001.

	Number of Observed Species	Jackknife Estimate	% Increase of Estimate from Observed
Desert Scrub	43	57.4	25.1
Pinyon/juniper	43	57.9	25.7
Riparian	51	68.3	25.3
Willow/scrub	32	40.4	20.8

RECOMMENDATIONS FOR 2002

The 2001 field season was a success. Baseline inventories were assembled for Southern Colorado Plateau National Parks (Aztec Ruins NM, El Morro NM, Petroglyph NM, Salinas Pueblo Missions NM, and Yucca House NM) that previously had little reliable information concerning bird species richness or distribution. Point count stations were established and critical habitats requiring area searches were identified.

According to our species area curves, which give us a reliable estimate of effort of work needed to identify at least 90% of the species present, the average number of species detected (species-effort) per habitat was between 89% and 100% of the total number of species per park (Tables 2c, 3c, 4c, 5c and 6c). This is the percentage of the actual number of observed species for AZRU, ELMO, PETR, SAPU and YUHO where standardized point counts were completed. Jackknife estimates revealed that our point count surveys in each park detected the common species, and we anticipate that further surveying in 2002 will detect the rare and inconspicuous species in each park (Tables 2d, 3d, 4d, 5d and 6d).

To accomplish the above goals in 2002, we will increase the number of point counts conducted particularly in habitats that were well below the 90% target. We will also focus on area searches in habitats where certain species are likely to occur but have not yet been detected. Playback of recorded calls will also be implemented to increase the probability of detecting rare species and inconspicuous species. We will include the playback procedure in habitats that target these specific species. Broadcasting of taped calls will occur in the habitats that the standard count survey is not being done or after the standard count period is completed.

One other area of concentration in 2002 will be nighttime surveys for owls. Although these were conducted in all parks, few of them resulted in detections. This may be due to the survey start date that was later than the peak of the breeding season for some of these target species. Night surveys will begin earlier in the 2002 season, thereby increasing the likelihood of detecting owl species that may be breeding in these parks.

Since this is the first year of a two-year study, management and monitoring recommendations will be discussed in our final report after we complete our second and final field season in 2002. Thus, the goals of this project should be accomplished with the completion of the 2002 survey season and subsequent data analyses.

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